REMARKS

Applicant has read and considered the Office Action dated July 28, 2003 and the references cited therein. Reconsideration and reexamination are hereby requested.

In the Action, the election to the previous Restriction Requirement with traverse was acknowledged. Applicant notes that claims 19-36 are withdrawn.

The objection to claim 15 was corrected by a previous Amendment and has been withdrawn.

Claims 1-3, 5-6, 8-10 and 12-13 were rejected as being unpatentable over U.S. Patent No. 5,831,266 (JEROMINEK et al.) in view of U.S. Patent No. 5,443,685 (GOOSSEN et al.), further in view of U.S. Patent No. 5,744,284 (LAUB et al.), further in view of U.S. Patent No. 5,841,143 (TUMA et al.) and further in view of U.S. Patent No. 5,955,817 (DHULER et al.). Claims 4, 7, 11 and 14-18 were rejected as being unpatentable over JEROMINEK in view of GOOSSEN, LAUB, TUMA, and DHULER, and further in view of U.S. Patent No. 5,559,358 (BURNS et al.).

Claims 1-3 of the present patent application are rejected in view of U.S. Patent No. 5,831,266 (JEROMINEK et al.), U.S. Patent No. 5,443,685 (GOOSSEN et al.) and U.S. Patent No. 5,744,284 (LAUB et al.). The Examiner points out on page 11 of the Office Action, that in U.S. Patent No. 5,831,266 (JEROMINEK et al.), Figures 1 and 2B of a diagonal cross-section through the center of inverted pyramid shaped supports (legs 14 and cavities 4, respectively) suggest fabrication of a plateau with two opposite slopes, each having a predetermined angle in which the predetermined angles are substantially equal, as recited in claims 2 and 3 of the present application. Moreover, the Examiner alleges on page 4 of his report, that JEROMINEK, as taught in the U.S. Patent No. 5,831,266 has used standard, i.e. binary, lithography to create a sloped pattern in these pyramid shaped supports.

Applicant asserts that there is a great difference between the entire shape of a particular microstructure and the shape of one of its cross sections. There are many different shapes of microstructures that show in one or even several particular cross sections a plateau having opposite continuous slopes, each having substantially equal predetermined angles but still, the

entire shape of these microstructures will be different. In the present patent application, the shape of a suspended microstructure, not a particular cross section, is recited in claims 2-3.

Moreover, as described on page 4 of our previous response, the sloped shape of the legs 14 from Figure 1 and cavities 4 from Figure 2B of JEROMINEK results from the imperfections of the standard photolithographic and etching processes, and that these imperfections are uncontrollable, as is the angle of this sloped shape. Moreover, the sloped shaping of the legs 14 and cavities 4 would not bring any improvements to these elements, but could even complicate the manufacturing process more. In the present patent application, the step of (b) photolithographically transferring a sloped pattern to the third photoresist layer by means of a grey scale mask is necessary in order to allow full control over the sloped shape of the suspended microstructure proposed (claims 1-3).

Furthermore, the Examiner points out that the use of a grey scale mask to form a sloped pattern by photolithography and subsequent etching or coating was not new at the time the invention from the present application was made. To this end, the Examiner refers to U.S. Patent No. 5,443,685 (GOOSSEN et al.). The GOOSSEN invention relates to semiconductor wafer preparation to facilitate epitaxial growth of polar semiconductors. A sloped shape is produced in the semiconductor substrate 1 (Figure 1) at a growth site 6 (Figure 2) using an erodible material 8 (Figure 2) such as a photoresist. This erodible material 8 is irradiated through a grey scale mask to produce a taper 10 (Figure 3). The semiconductor substrate 1 is then etched through the erodible layer 8 to obtain a tapered growth site 12 (Figure 5) in this semiconductor substrate. A temporary layer separate from the erodible photoresist layer is not mentioned.

Applicant understands that the grey scale mask lithography itself was known at the time the present invention was made. However, what is believed to be novel and not obvious to one of ordinary skill in the art, is the combination of the steps of claim 1, including step (b) of photolithographically transferring a sloped pattern to the third photoresist layer by means of a grey scale mask to fabricate a suspended microstructure comprising a series of layers deposited on top of a sacrificial layer, not just to generate slopes by etching of the bulk semiconductor wafers. There is a significant difference in the expertise required to prepare substrate materials such as semiconductor wafers for the epitaxial growth and the expertise required to design and

produce suspended microstructures operating as sensors, detectors, emitters, etc. Even a greater ingenuity (not just simple ordinary skill) is required to apply the grey scale mask lithography in order to produce suspended microstructures of a particular form including a plateau with two opposite sloped tapered supports via shaping of a temporary layer and other steps, not just tapering the supporting substrate.

Furthermore, the Examiner refers to U.S. Patent No. 5,744,284 (LAUB et al.). The LAUB patent teaches a method for fabricating microbridges uniquely making use of the uniform thickness photoresist temporary layer (i.e. there are no two distinctive layers such as a temporary layer and a photoresist layer as in the present patent application) that is shaped using a standard photolithographic process making use of an ordinary binary mask (See Figure 4C, column 5, lines 43 to 46). After completion of this operation, the photoresist has a rectangular shape with sharp corners (Figure 4D, column 5, lines 53 to 56). Then, the photoresist is subjected to a reflow, i.e. an intense heating that makes it viscous in such a manner that it flows in accordance with surface tension, and becomes rounded (Figure 4E, column 5, lines 56 to 67). It is known in the art that the viscous flow subjected to surface tension can only create spherical or partial spherical shapes (Figure 4E) without any control over the slopes. This technology is rather simple and it does not allow producing a suspended microstructure with a sloped support having a continuous slope with a predetermined angle. Moreover, contrary to claim 1 of the present patent application, the shaped photoresist of the LAUB patent is not used for transferring its shape into a different (temporary) layer by an etching technique. Furthermore, the photoresist shape of the LAUB patent (Figure 4E) does not show a continuous slope with a predetermined angle.

The LAUB invention relates to a method of making resilient 2-axis contacts to electrically interconnect ICs formed on respective carriers. The manufacturing method proposed by LAUB is completely different from the manufacturing method described in this patent application, but quite sufficient in terms of the contact shape control required for the identified application, as stated by LAUB in column 6, lines 52 to 65 (and emphasized in the Office Action on page 6). The shape of the microbridges produced by LAUB is also different than the shape of the microstructures from this patent application, but still optimal for the identified application as well. It is obvious to one skilled in the art that application of the grey scale mask lithography

and the additional temporary layer separate from the photoresist layer would unnecessarily complicate the manufacturing process proposed by LAUB and thus it would reduce its advantages for the identified application. Therefore, the fabrication process proposed by LAUB cannot be applied to manufacturing the particular microstructures as described in the present patent application and the combination of LAUB's process with the grey scale mask lithography would lead to a process not useful either for manufacturing of electrical contacts or for the suspended microstructures of this patent application.

Considering the JEROMINEK, GOOSEN and LAUB patents together, one sees that in the JEROMINEK patent, the sloped shape is an unwanted by-product of a less than optimal manufacturing process and the controlled shape of the microstructure does not include a plateau and sloped supports, that in the GOOSEN patent, the grey scale mask lithography is used to modify the substrate semiconductor wafers by adding tapers, and that in the LAUB patent, the application of teachings of the other two patents would only reduce the advantages of the invented manufacturing process. Consequently, Applicant asserts that combining the teachings of these three patents would still not lead to the invention recited in claims 1-3 of this patent application by one ordinarily skilled in the art.

Furthermore, it is believed that the combination of the teachings of these patents discussed above with U.S. Patent No. 5,841,143 (TUMA at al.) and U.S. Patent No. 5,955,817 (DHULER et al.) will not lead a person skilled in the art to the present invention as recited in claims 1-3.

The Examiner agrees (page 8 of the Office Action) that U.S. Patent No. 5,831,266 (JEROMINEK et al.), U.S. Patent No. 5,443,685 (GOOSEN et al.), U.S. Patent No. 5,744,284 (LAUB et al.), as well as U.S. Patent No. 5,841, 143 (TUMA et al.), and U.S. Patent No. 5,955,817 (DHULER et al.) do not specify deposition of a 5^{th} planarization layer (in addition to the 2^{nd} temporary layer) before depositing a 6^{th} layer, as recited in claim 4 of the present patent application. This is obvious since the manufacturing of the microstructures described in these patents does not require utilization of a planarization layer. However, the Examiner alleges (page 8 of the Office Action) that the U.S. Patent No. 5,559,358 (BURNS et al.) describes the utilization of a separate planarization layer and thus a combination of patents by JEROMINEK,

GOOSEN, LAUB, TUMA, DHULER and BURNS would make the content of claim 4 obvious to one of ordinary skill in the art.

A careful review of U.S. Patent No. 5,559,358 (BURNS et al.) shows that this patent does not teach the utilization of a planarization layer separate from a temporary layer. Only a temporary layer is present. This layer is produced twice; the first time, this temporary layer is grown and subsequently stripped, and the second time, this temporary layer is regrown to a similar thickness resulting in a nearly planar surface for the microbeam (vibratory member) (See column 18, lines 60 to 66, and Figure 9B).

Furthermore, the fabrication scheme presented by BURNS and consisting of the temporary layer deposition-stripping-deposition sequence cannot be applied to manufacturing the suspended microstructure shown in Figures 6 and 10 of the present patent application. Referring now to Figure 10 of the present patent application, a stripping and a subsequent deposition of the temporary layer 71 would result in a total destruction of the already produced sloped supporting members 96. Therefore, the BURNS reference teaches away from the present invention.

Consequently, the combined patents by JEROMINEK, GOOSEN, LAUB, TUMA, DHULER and BURNS do not introduce a separate planarization layer and thus, these patents do not teach or suggest all the characteristics of claim 4 of the present patent application.

Applicant asserts that the remaining dependent claims are also believed to be in condition for allowance for similar reasons.

In view of the above amendments and remarks, Applicant respectfully requests a Notice of Allowance. If the Examiner believes a telephone conference would advance the prosecution of this application, the Examiner is invited to telephone the undersigned at the below-listed telephone number.

Respectfully submitted,

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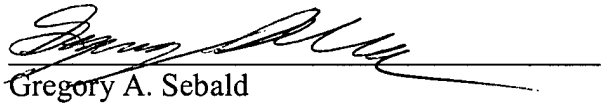

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